Education Systems in the Digital Age: The Need for Alignment

Education systems in the Digital Age: The need for alignment

Deirdre Butler (1), Margaret Leahy (2) and Peter Twining (3) with Ben Akoh (4), Yousra Chtouki (5), Sara Farshadnia (6), Kanda Moore (7), Roumen Nikolov (8), Carlos Pascual (9), Barbara Sherman (10), Teemu Valtonen (11)

1 Dublin City University, Ireland
2 Dublin City University, Ireland
3 The Open University, Milton Keynes, MK7 6AA, UK
4 Ulink Insights, Canada
5 Al Akhawayn University, Morocco
6 University of Canterbury, New Zealand
7 Kasetsart University, Thailand
8 ULSIT, Bulgaria
9 Addis Ababa Science and Technology University, Ethiopia
10 Cambodia Foundation for Higher Education
11 University of Eastern Finland, Finland

Corresponding author: Margaret.leahy@dcu.ie

We would also like to acknowledge the contributions of Amanda Sherman (Cambodia Foundation for Higher Education) to the TWG1 discussions at EDUsummIT 2017.

Abstract

The focus of Thematic Working Group 1 (TWG1) at EDUsummIT 2017 centred on the need for alignment in education systems and was driven by two key questions relating to a) if and how all the parts of an education system work together to support the type of learning envisioned in the 21st century, and b) if there is alignment, what is the purpose/vision of that education system and does it meet the needs of its learners. Arising from the discussions held, the group advocated the use of a tool such as the UNESCO framework (2008, 2011) as a way to conceptualize a systemic approach to reform and to enable policy makers and stakeholders in a system to think about ways in which they can align changes with the goals of any proposed reform. Taking the Irish Education system as an example, this paper illustrates how the UNESCO framework has enabled policy makers in Ireland to adopt a systemic approach to policy formulation which aligns educational strategies across a range of elements "to leverage strengths, coordinate investments, consolidate gains, and advance national development goals and visions" (Kozma, 2005, p.148). To counter the potential danger of a top-down imposition of the UNESCO framework, the group also proposed the Educational Vision and Mission Framework (EVMF) as a tool to support system wide (both top-down and bottom-up) reflection on the purposes of schooling in a rapidly changing world. The group concluded that what is defined as the purpose of education should inform alignment and suggest that application of the UNESCO framework and EVMF could enable the necessary alignment to support the educational, social, and economic transformation necessary for the complex connected global world of today and tomorrow.

Keywords

Alignment

Schools

Educational vision

Purpose of education

Introduction

The importance of having alignment between education visions, policy and practice is well established (e.g. Butler et al., 2013; Fullan, 2013; Twining et al., 2013). However, what is less clear is what the purposes of education systems should be in a rapidly changing world, and thus what educational visions, policies and practices might be most appropriate. Mindful of Dewey's (1934) advice that "any education is, in its forms and methods, an outgrowth of the needs of the

society in which it exists", questions of how best to shape a purpose or vision for education in the 21st century are critical to any conversation around the need for alignment. Key to all such conversations is the understanding that what is defined as the purpose of education will inform alignment and determine if all students experience a quality education (UN Sustainable Development Goal No. 4, http://www.un.org/sustainabledevelopment/education/) whereby they acquire the knowledge, skills, abilities and competencies to be successful in the complex digital world of the 21st century.

At EDUsummIT 2017, the focus of TWG1 centred on the need for alignment in education systems in the Digital Age. Discussions centred on if and how all the parts of a system work together to support the type of learning envisioned in the 21st century. If alignment exists, then we need to ask 'what is the purpose/vision of that education system and does it meet the needs of its learners?This is because aligning with purposes that do not reflect the needs of society are counter productive. If there is not alignment, we need to ask, why not and what can be done to achieve alignment? The group was concerned with two key questions in this regard:

- How do we get alignment between educational visions/purposes, policies (e.g. curriculum), assessment and accountability systems, teacher learning and practice within (rather than across) education systems?
- What is the purpose of education in a globally complex world, and thus what educational visions, policies and practices might be most appropriate?

In answering these questions, attention of the group was directed exclusively on the schools sector (primary and secondary). The paper seeks to address these questions, extending the discussions at EDUsummIT 2017 and applying a theoretical lens that enhances and deepens the discussion of TWG1. The paper begins by outlining the importance of alignment in education systems; it then critically reviews and analyzes the education system in one country, Ireland, from the perspective of alignment; the final section investigates the purpose of education in a digital world.

The Need for Alignment

While ICT has transformed the global economy and the way people around the world, work, live and play, it has yet to have such an impact on education practices globally and on what and how people learn in schools (Kozma, 2011). Schools, despite large investment, in many countries have not yet taken advantage of the potential of technology in the classroom, leading commentators such as the OECD's Andreas Schleicher to note:

> School systems need to find more effective ways to integrate technology into teaching and learning to provide educators with learning environments that support 21st century pedagogies and provide children with the 21st century skills they need to succeed in tomorrow's world (OECD, 2015, http://www.oecd.org/education/new-approach-needed-to-deliver-on-technologys-potential-in-schools.htm)

Research evidence has repeatedly reinforced that the introduction of ICT into schools does not in and of itself lead to the development of innovative teaching practices or the transformation of education (e.g. European Schoolnet and University of Liège, 2013; Kozma, 2003; Law et al., 2008; OECD, 2015; Shear et al., 2009; Shear et al., 2011; Twining, 2017). However while ICT per se is not necessarily a driver or catalyst for change, evidence also demonstrates that ICT can have a greater impact when the policies and programmes designed to implement it are aligned with other aspects of the education system; i.e. where there is already a commitment to school wide innovation or change, ICT can serve as a lever to accelerate the intended changes (Law, 2013). For example, in studies such as SITES-M2 (Kozma, 2003) which explored the role of ICT in transforming education, innovations aligned with national and local policies were found to be more likely to report changes in teacher classroom activities and outcomes of both teachers (new pedagogical skills and collaborative skills) and students (problem solving skills and metacognitive skills). In addition, those cases linked to supportive national policies were likely to show evidence of both sustained practice and of being migrated to other settings.

Building on these findings (Kozma, 2005; 2008; 2011) and drawing on the work of Fullan (2013), there is need to engage the whole system to bring about educational transformation; any processes of reform in schools and classrooms cannot be implemented or understood in isolation but rather must be considered within the context of the entire education system. This implies that if any process of education reform is to have the ultimate intended effects, the relationship between the reform and the desired outcomes must be explicated and these outcomes must be built into policies and programs designed to implement them (Kozma, 2005; 2011).

ICT is therefore only one part of a complex jigsaw. If change is to occur and ICT successfully used to support learning, there is a need to consider all of the components of the system in a coordinated and coherent way. This includes policy, goals and visions of education, along with the following components of system: infrastructure development, teacher professional development, technical support, pedagogical and curricular change and content development (Kozma, 2008) - all of which must work together and reinforce each other as part of an interrelated and interdependent learning ecosystem if a reform can be successfully implemented and sustained (Figure 1).

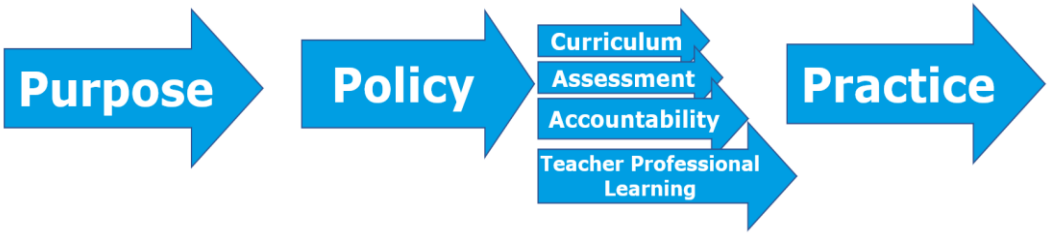

Figure 1: The key elements of alignment in education

Finally, it is noted that while a systemic approach can improve understandings of how ICT-based reform can be successfully implemented and sustained, systemic reform is challenging. The process of embedding ICT into educational systems to promote system wide transformation is far more challenging and complex than simply promoting its use to support traditional forms of education or adding IT as a curricular discipline in its own right (Law, 2008). The successful

implementation of any reform depends on factors ranging from the inclusion of a vision that is shared and communicated across all stakeholders, investment in resources to support the innovation and stakeholders committed to ensuring full implementation, continuous improvement, and sustainability (Russell, 2016). It is also shaped by a complex interaction of a range of contextual factors including national and regional policy, cultural norms and values, leadership, teacher attitudes and skills, and student characteristics (Owston, 2003). Account must be taken of these factors across at least three levels of the system if pedagogical transformation is to occur:

- at **macro-level**, system factors such as cultural norms, social context, educational policy, curriculum standards, etc. must be taken into account;
- at **meso-level** school factors such as IT infrastructure available, IT integration plans, school leadership, innovation history, parents, etc.; and
- at **micro level**, individual factors for teachers, such as pedagogical practice, innovation history, educational background, experience with technology, etc.; and for pupils, such as experience with technology, social and cultural background, etc.(Kozma, 2003).

The factors at each level are compared by Moonen (2008) to the cogwheels of a watch whereby turning one wheel starts or follows the turn of many other connected wheels. Fullan (2006) refers to this connectedness of factors as 'permeable connectivity' and stresses the need to pursue "strategies that promote mutual interaction and influence within and across the three levels" (p.11). It must also be acknowledged that in many countries the intermediary levels between schools (meso) and governments (macro) (EA's, educational networks) can be strong forces in the promotion (and resistance) towards change. This implies that the introduction of a new aspect such as ICT into a system will necessarily impact on many other aspects of the system; and not taking cognisance of this impact "is almost a guarantee for failure" (Moonen, 2008, p.1077). It also implies that a "one-size-fits-all" approach to reform would not be successful within education systems. Rather, national goals, approaches, and priorities must align with the contexts and values of local school communities. And that alignment cannot be achieved unilaterally; it requires careful consideration and engagement by groups

and individuals who influence education policy, resources, and decisions within the school community (Russell, 2016).

The UNESCO framework

The process of embedding ICT into educational systems to promote system wide transformation is a challenging and complex process. The use of frameworks can enable policy makers and other stakeholders to conceptualize a systemic approach to reform and to think about the way in which they can align changes with the goals of a proposed reform. The tool TWG1 used to describe and analyse the education systems within their various countries was the UNESCO framework (2008, 2008a, 2011). It was agreed that this framework was a useful "barometer" against which to review and interrogate what has been accomplished in countries to date and to provide indicators of what needs to be developed going forward.

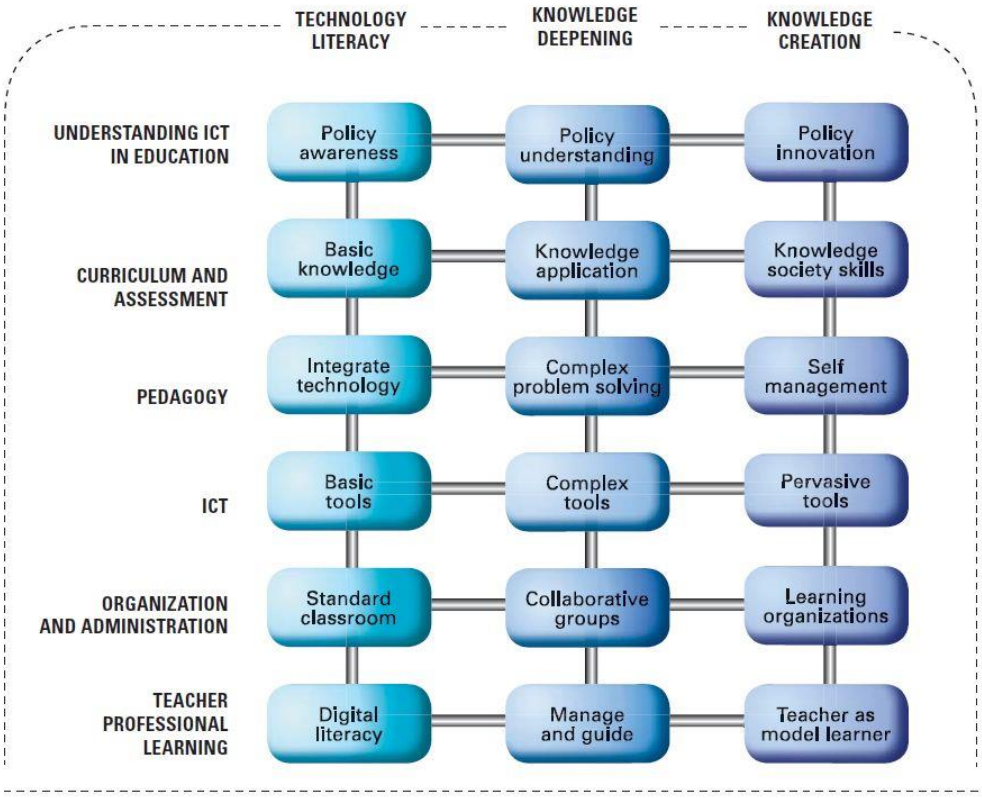

Figure 2: The UNESCO Framework for ICT Policies to Transform Education

Comprising six key aspects of a learning system, the UNESCO framework seeks to address the implications that different policy goals and visions of ICT may have for the other components of the education system: pedagogy, teacher

practice and professional development, curriculum and assessment, and school organisation and administration (Figure 2).

The framework also identifies three complementary, somewhat overlapping approaches that connect education policy with economic and social development: *technology literacy*, *knowledge deepening* and *knowledge creation:*

- Increase the technological skills of students, citizens, and the workforce by incorporating such skills in the curriculum—or the technology literacy approach.
- Increase the ability of students, citizens, and the workforce to use knowledge to add value to society and the economy by applying it to solve complex, real-world problems—or the knowledge deepening approach.
- Increase the ability of students, citizens, and the workforce to innovate, produce new knowledge, and benefit from this new knowledge—or the knowledge creation approach (UNESCO, 2008, p.8).

The likelihood in any education system is that the different components are more or less advanced and that the key to moving toward knowledge creation is to use current strengths as a lever to push forward other components of the system (UNESCO, 2008a; 2011). For example, as illustrated in Figure 3, the country represented in the spider diagram could leverage current strengths in teacher professional development and pedagogy to advance curriculum, assessment, and school organization.

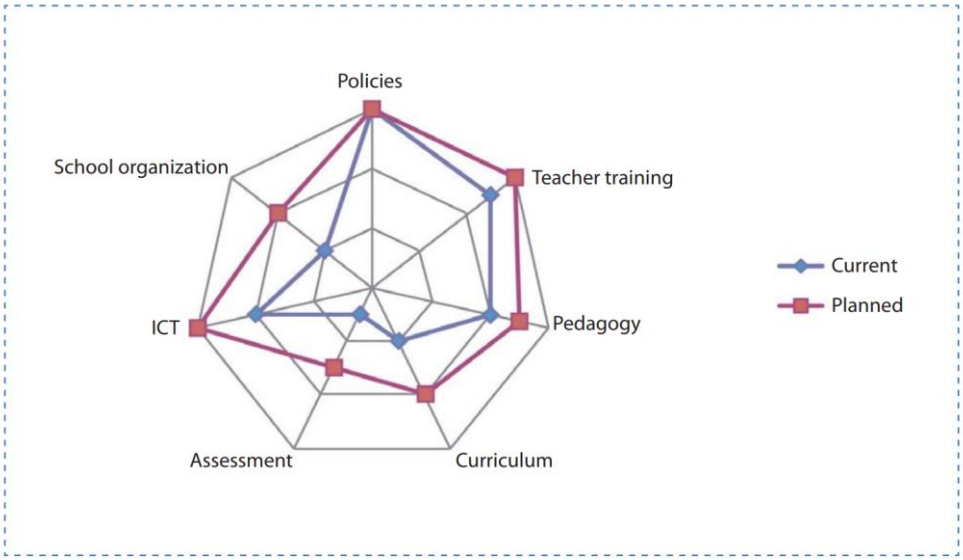

Figure 3: Diagram of Development Paths in the use of ICT in an Education System (UNESCO, 2011, p. 17)

An example from Ireland

After two decades of ICT related policy in Ireland, there was little evidence of any system wide transformation of education. The introduction and use of the UNESCO framework for the conceptualization and design of the most recent ICT policies for schools (DES, 2015) enabled policy makers to identify the shift that was required in policy design; it crystallized for them the interconnectedness of the aspects of the learning eco-system, and helped them to understand the deliberate links that needed to be made between policy and practice in order for systemic change to emerge.

Using the UNESCO Framework (2011) and drawing on Butler et al. (2013) and Cosgrave et al. (2014) what follows is a overview of how issues of alignment between and across the elements of the education system in Ireland were addressed in the conceptualization and design of the Digital Strategy for Schools 2015-2020 (DES, 2015).

Understanding ICT in Education (Policy)

Without a shared vision to guide the national use of technology in education, ICT policy is only operational - it can become techno-centric, promoting the purchase of equipment and the organization of teacher training without providing a strong educational purpose or goal for the use of technology (Kozma, 2008). As previously stated, in order for digital technologies to be effectively used in teaching and learning at school level, its use has to be part of the school vision and must be supported by specific national policies and strategies (Plomp et al., 2009; Shear et al., 2011). This has been already occuring in Ireland to a large extent. The use of digital technologies as an integral part of teaching, learning and assessment has been endorsed in all recent educational policies and plans. The National Strategy to Improve Literacy and Numeracy among Children and Young People (2011-2020) (DES, 2011); Project Maths (NCCA, 2008), Key Skills Famework (NCCA, 2009) the Framework for the Junior Cycle (DES, 2012), and The School Self-Evaluation Programme (DES, 2012a; 2012b) all require that ICT is used as a part of student learning. In addition, the Irish Teaching Council has identified ICT as a key national priority area (The Teaching Council, 2011).

Despite this, through engagement with the UNESCO framework and the consultative process which underpinned the development of the Digital Strategy for Schools (DES, 2015), it became evident to policy makers that these policies tended to be perceived a separate fragmented elements. They accordingly came to the realisation that, rather than be seen as yet another policy, the new Digital Strategy for Schools should be the glue that would not only leverage existing policies but would also be the catalyst for enabling the move towards systemic tranformation of Irish schools. To do this, the ICT policy unit in the Department of Education and Science (DES) could no longer operate in isolation but needed to become the hub which consulted across all agencies and institutions. In doing so, it could formulate an ICT Strategy that would clarify for schools how it related to other policies; and would build a bridge enabling educators to understand the policy ideas and thus link them to their classroom practice.

ICT Infrastructure

EU surveys (e.g. European Schoolnet and University of Liège, 2013; Eurydice, 2011) published when the Digital Strategy was in development reported that Ireland ranked close to or slightly above average across a range of indicators including computer to pupil ratios and internet connectivity. Despite this, the 2013 ICT Census of Schools (Cosgrove et al., 2014) highlighted issues such as lack of technical support and lack of high speed broadband as obstacles to embedding digital technologies in Teaching, Learning and Assessment (TLA). Consequently, it was acknowledged by policymakers that funding needed to be allocated towards the provision of a robust infrastructure that would provide teachers and students with relevant resources when and where they are needed. However and significantly, what became evident when reflecting on the other elements of the UNESCO Framework was that spending limited resources on building infrastructure was irresponsible unless it was informed by schools' clearly identified needs, combined with plans which outlined how they were to develop appropriate learning contexts which embedded the use of digital technologies for TLA.

Furthermore, to ensure that demands for ICT resources were underpinned by a clear focus on a learning rationale, emphasis in the implementation of the Digital Strategy for Schools was placed on developing mechanisms that would help schools articulate their needs while being supported appropriately by the government agencies (e.g. Professional Development Support Services for Teachers (PDST)). In this way, the UNESCO framework enabled policy makers to understand more concretely the interdependencies between the infrastructure, curriculum and teacher professional learning that need to be planned for and supported across all levels within the eco-system.

Curriculum and Assessment

In Ireland, as highlighted in the ICT Census of Schools Report (Cosgrave et al., 2014), the range of purposes for which teachers most frequently used ICT focused mainly on presenting information in class, accessing curriculum-relevant online resources for lesson preparation, and using applications to prepare resources for class. These response patterns are indicative of a more traditional view of learning (Technology Literacy level in UNESCO framework), where ICT is used to strengthen existing teaching and learning practices, rather than as learning tools to develop the qualities that prepare students to live and work in a digital society. These skills, often referred to as "21st century skills", "Key Skills" or "Key Competencies" (ETA, 2010; OECD, 2005; NCCA, 2009) include critical thinking and problem solving, communication, collaboration, self-regulation and information management (Binkley et al., 2012; Partnership for the 21st Century, 2008). The ability to use technology effectively and reflectively is identified as integral in the development of each of these skills. These skills have been highlighted for development in other curriculum related policies in Ireland (listed previously) . For example, the Framework for the Junior Cycle at Secondary level (DES, 2012) reflects the shift towards collaborative problem solving and higher-order thinking, and states that the student should use "technology and digital media tools to learn, communicate, work and think collaboratively and creatively in a responsible and ethical manner" (p. 6). Despite this, the 2013 ICT Census of Schools (Cosgrove et al., 2014) indicated that many teachers were likely to lack

the knowledge and skills to implement ICT effectively in ways that engaged and challenged students (e.g. social networking, web 2.0 tools).

It became evident to policy makers that curriculum policies were generally not being embraced at the practice level in classrooms when it came to embedding the use of digital technologies. To address this, the new Digital Strategy for School (DES, 2015) stresses the potential of digital technologies to transform student learning experiences by helping students become engaged thinkers, active learners, knowledge constructors and global citizens to participate fully in society and the economy. In addition, the DES mandated that all new curriculum developments are to embed the use of digital technologies. However, a key difference now is that there is a new realization that pedagogical orientation of teachers needs to be addressed to embed digital technologies with emphasis on high levels of understanding of key concepts within subject areas and the ability to apply these concepts to solve complex real-world problems (Bransford, Brown, & Cocking, 2000). In tandem, the dialogue around digitally supported assessment has begun with a number of collaborations, both national and international, investigating the use of digital portfolios for learning (for example, EUFolio, https://eufolio-resources.eu/ and ATS2020, http://www.ats2020.eu/).

Pedagogy

The concept of teaching and learning through the use of ICT is highly complex. The introduction of ICT into a learning environment does not in and of itself bring about change in pedagogical practice. Rather, its use in education is inextricably linked with understandings of the nature of knowledge and the nature of knowing. Research studies have repeatedly demonstrated that a teacher‘s pedagogical orientation is a dominent factor in how they use ICT in their classroom (e.g. Law et al., 2008; Plomp et al., 2009; Shear et al., 2010; Shear et al., 2011) and computer-based interventions tend to be more effective when combined with constructivist approaches to teaching, rather than with more traditional approaches (e.g. Becker, 2000; Li & Ma, 2010; Sandholtz, et al., 1997).

Surveys in Ireland report that teachers use ICT to work with students during lessons and, where they do, the range of ICT use is limited (Conway & Brennan, 2009; Cosgrove & Marshall, 2008; DES, 2008; European Schoolnet and University of Liege, 2013; Cosgrave et al., 2014). What these data sources suggest is that, for the most part, the use of ICT in schools is at the *technology literacy level* (UNESCO, 2008; 2008a; 2011).

This finding indicated to policy makers that, although a broad range of recent curriculum policies had constructivist underpinnings, this did not necessarily translate to classroom practice and in particular in the ways ICT was used for TLA. So although the DES intended to mandate that all new curriculum developments were to embed the use of digital technologies, there was a new realisation that pedagogical orientation of teachers needed to be addressed. Emerging from these findings and acting on recommendations fron the ICT Census of Schools Report (Cosgrave et al., 2014), a key principle in the Digital Strategy was that a constructivist pedagogical orientation is essential if teachers are to move from Technology Literacy to the next stage of Knowledge Deepening (enabling students to acquire in-depth knowledge of their school subjects and apply it to complex, real-world problems). The changes in curriculum and assessment at both primary and post primary levels (e.g. Junior Cycle, Project Maths, Integrated primary language curriculum for infants to second class, review of primary maths, and revision of the senior cycle sciences) will provide an opportunity to promote understandings of how to make innovative uses of ICT beyond "integration". A critical element to enable this will be the development of an appropriate model of teacher professional learning.

Teacher Professional Learning

Today essential "integral skills in every teacher's professional repertoire" are the ability not only to be prepared to use technology but also to know how to use technology to support student learning (UNESCO, 2008, p.1).

Initial ICT policy initiatives (e.g. DES,1997: DES, 2001) in Ireland, as in many countries (Plomp et al., 2009), focussed on developing technology literacy

resulting in programmes for "upskilling" teachers with basic "ICT competencies" and pedagogical use of basic ICT tools in the curriculum subjects (Plomp et al., 2009). Findings from the ICT Census of Schools Report (Cosgrave et al., 2014) raised concerns among policy makers that these models of professional development were in reality 'retooling' teachers for specific tasks, rather than engaging in pedagogy of a substantial nature (Watson, 2001).

To move forward there was a realization that as advocated by the ICT Census Report (Cosgrave et al., 2014) and the Irish Teaching Council (2011), it was necessary to develop a model of professional learning that would foster a culture of "ongoing professional learning" based on teachers' active engagement in their own learning, for their benefit and that of their students.

It is accepted that to be effective teachers' learning should be linked to teachers' needs, students' needs and school needs, and differentiated to suit the culture and context of teachers' work (Darling-Hammond & Bransford. 2007; Fullan, 2013; Shear et al., 2011; Twinning et al., 2013). This is consistent with the principles underpinning the existing school self-evaluation process in Ireland (DES, 2012a; DES, 2012b) and the associated Looking at our Schools Quality Framework (DES 2016a, 2016b).

Research has found that many school leaders do not have a good sense of the ways in which teachers are using ICT and of how to evaluate these uses of ICT (Butler et al., 2013). This implies a need to articulate what effective practices look like when using ICT in specific contexts so that teachers and school leaders can enhance and change their existing practices. Recognising the need to articulate these effective practices, the DES established a design team to review and adapt the UNESCO Framework (UNESCO 2011) in order to contexualise it for the Irish education system. This group began by commissioning a review of the literature and practices worldwide in relation to competency frameworks (Hallissy & Hurley, 2016). This review in turn informed the design of a Digital Learning Framework for Schools (DLF). The DLF (DES 2017) was designed as a support to the Digital Strategy for Schools (DES, 2015) and to help teachers embed the use of digital technologies in learning, teaching and assessment as envisioned in

the strategy. It is articulated as a set of domains and standard statements across two dimensions: Teaching and Learning, and Leadership and Management. Each standard is illustrated by least one example of effective and highly effective practice (Butler, Hallissy & Hurley, 2018). In this way, the Digital Learning Framework (DLF) for teachers / schools is grounded in classroom practice and organized so that teachers can identify their existing practice and compare it to a range of other practices. This DLF (DES, 2017a; 2017b) and the associated guidelines which are being piloted with 50 schools (October 2017 – June 2018) will become mainstreamed in September 2018 for all schools.

Finally, the Digital Strategy (DES, 2015) also encourages the development of communities of practice across schools and is supporting this by funding innovative proposals for embedding digital technologies in TLA (https://www.education.ie/en/Press-Events/Press-Releases/2018-press-releases/PR2018-04-02.html). These clusters are supported by Higher Education Institutions (HEIs), and links with partners in the industry and enterprise sector are strongly encouraged.

Organisation of Learning/ Designing Learning Spaces

The literature notes that teachers' beliefs and attitudes to what characterises meaningful learning are inextricably linked to an institution's vision of how to use ICT (Ertmer, 2005) and how learning is organized within the school. In Ireland, the design of learning spaces can for the most part be described as traditional.

Changing pedagogical practices necessitates a corresponding appraisal of how learning spaces are conceptualized. This is imperative to enable the enquiry-based, collaborative nature of learning previously described in this paper. It can be enabled through the use of flexible and adaptable digitally-based resources and systems that provide high-quality learning opportunities with flexible timing and pacing through a range of learning environments. This will entail changes to the existing conceptions of timetabling and how learning is organized. It will also have implications for how teachers interact with one another and the relational roles/ responsibilities of teachers and students.

How can this be achieved is a challenge for policy makers. An advantage in one sense it that Ireland has a centralized school system and a school inspectorate who oversee the quality of teaching, learning and assessment in all schools. They have developed a process of school self evaluation which all schools are mandated to follow on an annual basis (DES, 2012a; DES, 2012b). This is augmented by the *Looking at our Schools Quality Framework* developed for the primary (DES, 2016a) and post-post-primary (DES, 2016b) sector. The new DLF has been designed to be embedded into this existing Framework that is used in the first instance by the school to review, evaluate and improve practice under the two domains (Teaching and Learning, and Leadership and Management). In addition, the Quality Framework is used by the inspectorate as the basis for external school evaluation, the reports of which are published online (http://www.education.ie/en/Publications/Inspection-Reports-Publications/).

To conclude, the pivotal role of the UNESCO framework in the conceptualization and design of the Digital Strategy for Schools 2015-2020 (DES, 2015) has enabled Irish policy makers to take into account all elements of the learning eco-system as they strive to to adopt a systemic approach to policy formulation which aligns educational strategies to embed digital technologies in teaching, learning and assessment. This stands in stark contrast to previous approaches which tended to conceptualize digital technologies in isolation, resulting in the development of what is is predominantly Technology Literacy. This time round, informed by the reflections enabled by use of the UNESCO framework as a mechanism for alignment, policy makers hope to shift classroom practices to those which are more characterized by Knowledge Deepening. The alignment it is hoped will translate policy into practice by developing teachers' understanding of the common principles underpinning the range of policy in relation to curriculum and assessment; promoting and supporting the development of a constructivist pedagogical orientation with appropriate teacher professional learning; and, consistently monitoring and reviewing school organization.

Core to the success of this Irish initiative is that there is a clear vision of what the purposes of education should be, namely moving from Technology Literacy to

Knowledge Deepening, and ultimately to Knowledge Construction (as described in the UNESCO Framework). However, across the countries represented in TWG1 it became apparent that that all education systems do not have such clear visions about the purposes of education. It was agreed that to enable systemic educational change a first step was that policy and practice need to be aligned with each other, and with clear understandings of the purposes of education. For this reason, the latter half of this paper interrogates what the purpose of education should be in rapidly changing, connected world.

The purpose of education

As stated at the outset, TWG1 recognised that key to the issue of alignment is the question of what one is aligning with. This goes back to a fundamental question about what the purposes of education are, and hence what an appropriate educational vision might look like. The discussions in TWG1 highlighted two problems related to getting alignment between purposes, policy and practice:

- alignment between policy and practice, but lack of alignment with the stated educational purposes;
- lack of a clear educational purposes with which to align policy and practice.

In both cases the key issues was felt to be the need to have an explicit and consistent view about the purposes of education.

Importance of having a vision

ICT is impacting on society in ways that should change our views about the purposes of education (e.g. Talbot, 1994; Conlon, 2000; Twining, 2014). Purposes of education inform educational visions. Of course, lots of possible purposes for education and hence educational visions exist, but unless we decide which vision we want we are unlikely to achieve it, and are likely to end up somewhere we do not want to be (Conlon, 2000). There is extensive evidence that having a shared vision is important for the success of educational institutions (National College of School Leadership 2003, 2004). This is perhaps not surprising as

> A vision provides orientation and meaning for leaders and their teams and is a strong driving force for ongoing and systematic practice development
> (Martin et al., 2014, p. 1)

Indeed, common sense suggests that without having shared purposes members of organizations are more likely to pull in different directions, undermining each other's efforts. Hill (2010, p. 28) notes that "Vision is a key part of ending up someplace on purpose". He goes on to note that a shared vision not only provides

> "a road map to help guide us" but can also "create a sense of anticipation that lets us experience a sense of fulfilment even before a goal is reached. … Vision provides the drive needed to pursue something to completion."
> (Hill, 2010, p. 29)

Around the globe, policy makers are realizing that education systems may need to change in order to meet the challenges of a rapidly evolving digital society. What is less clear is what the purposes of education systems should be in a rapidly changing world, and thus what the most appropriate educational vision that policies and practices need to align with might be.

Purpose of schooling

A great deal has been written about the purposes of education going back as far as Aristotle, Plato, Confucius, Locke and Rousseau. Dewey (1938) argued that the primary purpose of schooling was to prepare students to live 'pragmatically' and 'immediately' in their current context, rather than preparing them to 'lead a useful life'. Counts (1978) in contrast argued that the purpose of schooling should be to prepare students to participate in society and influence the social order.

Tyler's (1949) identified three main purposes underpinning the priorities for curriculum content:

- developing knowledge (academic and cultural heritage)
- social preparation (reflecting the needs and perseptives of society)
- personal development (reflecting the individual needs and interests of the learner)

This recognizes that schooling should address both individual and societal needs.

Alder (1982) similarly suggested three desired outcomes from schooling, though he emphasized the importance of work rather than the development of knowledge per se:

- the development of citizens
- personal improvement and growth
- preparation for work.

Labaree (1997) extended Alder's focus on an economic rationale for education, identifying that education can be for 'public' or 'private' good. 'Private good' would include providing an individual with a competitive advantage (e.g. a good qualification). 'Public good' might include developing economically productive workers or responsible citizens.

Building explicitly on the work of Dreze and Sens (2002), Robeyns (2006) identifies five roles that education can play:

- Intrinsically important – "knowing something simply for the sake of this knowledge" (p. 70)
- Instrumentally important personal economic
- Instrumentally important personal non-economic
- Instrumentally important collective economic
- Instrumentally important collective non-economic

In shifting from purposes of education to roles, Robeyns (2006) shifts the focus from the overarching rationles for schooling to intended outcomes.

Analysis of the intended outcomes of schooling

Members of EDUsummIT TWG1 set out to explore the purposes underpinning education policies in the countries they were based in, which included: Cambodia; England; Finland; Iran; Ireland; Manitoba (Canada); Morocco; New Zealand; Philippines; and Scotland. Members of TWG1 analyzed policy documents, government websites and other documentary evidence. It soon became clear that there was confusion about the differences between educational purpose, vision, mission and intended outcomes. Vision statements often focused on intended outcomes rather than the purposes of education, and there was a lack of clarity

about the mission (values, beliefs and critical elements guiding policy and practice).

Thus, these analyses resulted in the development of concise summaries of the intended outcomes of education in each jurisdiction. These summaries for each country were then analyzed to look for similarities and differences between them. Robeyns (2006) framework was used as a starting point for analyzing the intended outcomes of education in these ten jurisdictions. However, none of the ten jurisdictions focused on intrinsically important knowledge ("knowledge for knowledge's sake") and they tended to merge individual and collective good, seeing skills for life and work as spanning both. The analysis moved to a more inductive approach, using Emergent Themes Analysis (Wong & Blandford, 2002) of the intended outcomes of education in these jurisdictions. This involved:

- reading through all the summaries to identify initial themes;
- going back through each summary to to see whether or not the identified themes were represented, and if there were other intended outcomes that the themes did not cover;
- repeating the process until all of the elements of each summary had been captured within at least one theme.

This process resulted in seven clusters of intended outcomes, which are listed in Table 1, along with an indication of which jurisdiction referred to them.

The members of TWG1 were asked to analyze the intended outcomes of education in each of their jurisdictions against the seven themes to see whether they agreed with the original analysis and whether any intended outcomes of education had been omitted. The credibility of the original analysis was confirmed by the fact that the TWG1 members agreed with the analysis, which is summarized in Table 1.

Whilst the seven intended outcomes reflect purposes previously identified in the literature, this original analysis reveals some important and at times subtle differences, which are briefly explored below.

	Cambodia	England	Finland	Iran	Ireland	Manitoba (Canada)	Morocco	New Zealand	Philippines	Scotland
Access to high quality education for all	X	X	X	X	X	X	X	X	X	(X)
Citizenship (inc. sustainability)	X	X	X	X	X	X	X	X	X	X
Wellbeing and/or success of the individual		X	X	X	X	X		X		X
Generic 'knowledge' and 'skills'	X		X	X	X	X		X	X	X
Skills for life		X	X	X	X			X		X
Skills for work	X	X	X		X	X		X		X
Learning to learn or lifelong learning			X	X	X	X		X	X	X

Table 1: Thematic analysis of the purposes underpinning education in ten jurisdictions

Access to high quality education for all: was often referred to in terms of equality of access, excellence of provision (the need to improve quality in Cambodia), or enabling students to reach their full potential. Ireland also talked about the need for schooling to be cost-effective and judged against international standards. The Philippines focused on assuring the "capacity to fully exercise freedom by all". Whilst Scotland did not overtly talk about providing access in this way, it is implicit throughout the Scottish policies.

Citizenship (inc. sustainability): All ten sets of policies focussed on developing individuals as citizens. This was sometimes overtly in relation to sets of religious or other values and beliefs (Morocco, Iran). Whilst not overtly stating a particular set of religious values underpinning education, several of the jurisdictions (England, Ireland, Finland, Manitoba) were focussed on preparing young people to be effective members of that country's society. Scotland and the Philippines also focused on understanding one's place in the world, whilst in Cambodia the focus was overtly on achieving peace through educational reform that would help build a productive labour pool.

Wellbeing and/or success of the individual: balancing this universal focus on citizenship and the wellbeing of the community, seven of the ten jurisdictions also overtly highlighted the importance of the wellbeing and/or success of individuals. For example, Manitoba noted that every learner should complete school education with a profound sense of accomplishment, hope and optimism, whilst Iran's vision is to develop those values and skills in the students which contribute to the wellbeing of individuals by guiding them towards living an "excellent life" as described in Islamic doctrines. This contrasted with England where the focus was on protecting all children from harm and "vulnerable children" being supported to succeed, with all children achieving to the best of their ability.

Generic 'knowledge' and 'skills': such as literacy, numeracy and cognitive skills (Scotland), were explicitly referred to in eight of the ten jurisdictions. New Zealand talked about 'key competences', Finland used the term 'transversal competences', and Ireland referred to 'key skills'.

Skills for life: were referred to in six jurisdictions. For example, Finland talked about being able to take care of oneself and manage daily life, England referred to the skills and character to contribute to the UK's society, and Iran aimed for students to be self-confident, innovative, critical, independent, committed, honest, and justice-seekers.

Skills for work: seven jurisdictions referred explicitly to skills for work, for example: Cambodia concentrated on transforming their broken economy and focusing the curriculum on the future labour pool of Cambodia (agriculture, industry and services, and banking); Finland referred to 'working life competence' and entrepreneurship; and Manitoba talked about preparing students for active involvement in addressing issues of economic sustainability.

Learning to learn/Lifelong learning: seven of the jurisdictions explicitly referred to preparing students to be lifelong learners. This was phrased differently in different policies. For example, Iran referred to 'avid learners', the Philippines talked about engendering students' ability to develop themselves, Manitoba talked

about preparation to be lifelong learners, and New Zealand talked about learning to learn through reflection on their learning and learning processes.

Whilst there are considerable overlaps between the intended outcomes of education identified in the ten jurisdictions that the TWG1 members examined, there are some important, though sometimes subtle, differences. These perhaps reflected different views about what the world will be like in the future, different cultural beliefs, and the particular issues each jurisdiction perceived as being most important. Thus, they reflected different visions for education and also different missions (guiding values, beliefs and other critical elements). This fueled discussion within TWG1 about if and how all parts of the education system work together to support learning aligned with the needs of individuals and society in the 21st century. This raised the question of the importance of having alignment with an appropriate educational vision.

What might an appropriate educational vision look like?

Traditionally there has been an assumption that formal education will lead to employment:

> *Study hard! Get good grades! Go to college! Get a good job (for life).* And by making education freely available to all children, we're giving everyone an equal opportunity to succeed in life.
>
> (Jones, 2012)

However, in our rapidly changing world where some argue that automation will render large numbers of people unemployable (e.g. Ford, 2009), this narrative seems to be breaking down, raising questions about what the purpose(s) of schooling and our educational visions should be in the 21st century. This seems to be reflected in many of the countries' educational vision statements talking about 'generic knowledge and skills'. The overt focus on learning to learn is perhaps the most explicit recognition of the need for young people to be able to cope with a world in which the only thing we can be sure about in the future is that it will be different to today, though three countries' educational visions (England, Cambodia and Morocco) do not make explicit reference to it.

Activities within TWG1 focussed on the similarities and differences between the purposes of education evident in their countries and the differences of perspective underpinning them. The Educational Vision and Mision Framework (EVMF) was introduced as a tool to help the group to distill the key elements from what initially seemed like very diverse perspectives. Just as policy makers in the Irish example had the UNESCO framework to help think about systemic reform and development, the EVMF provided a framework to help structure and focus the discussion of educational visions and missions, drawing out key overlaps and sometimes subtle differences.

The Educational Vision and Mission Framework

The Educational Vision and Mission Framework[1] (EVMF, Twining, 2017), which is represented in Figure 4 below, was developed to encapsulate the key elements of the purposes of education evident in the literature, in 'vision statements' respectively from (i) schools in England and Australia (collected as part of the Vital and Snapshot Studies, http://edfutures.net/Research_Strategy); (ii) Twining et al's (2017) research looking at the purposes underpinning ICT use both inside and outside primary schools; (iii) the TWG1 members' summaries of the education visions in their respective countries; and (iv) in the Sustainable Development Goals (United Nations, 2015).

The EVMF recognizes that you need both a vision (an aspirational statement about where you are heading) and a mission which encapsulates values, beliefs and other critical elements that will guide you work towards achieving your vision.

The EVMF also recognizes the importance of both the individual (Individual fulfilment) and wider society, going beyond specific human societies to also encompass the broader issues of the wellbeing of our planet, its flora and fauna (Universal wellbeing). The 'vision statement' ('Individual fulfilment'/'Universal

[1] The Educational Vision and Mission Framework was originally called the Yin-Yang Vision but was renamed in response to feedback from education experts

wellbeing') is underpinned by the 'mission statement', with sets of attributes, values, and competences, theoretically informed by a sociocultural framework.

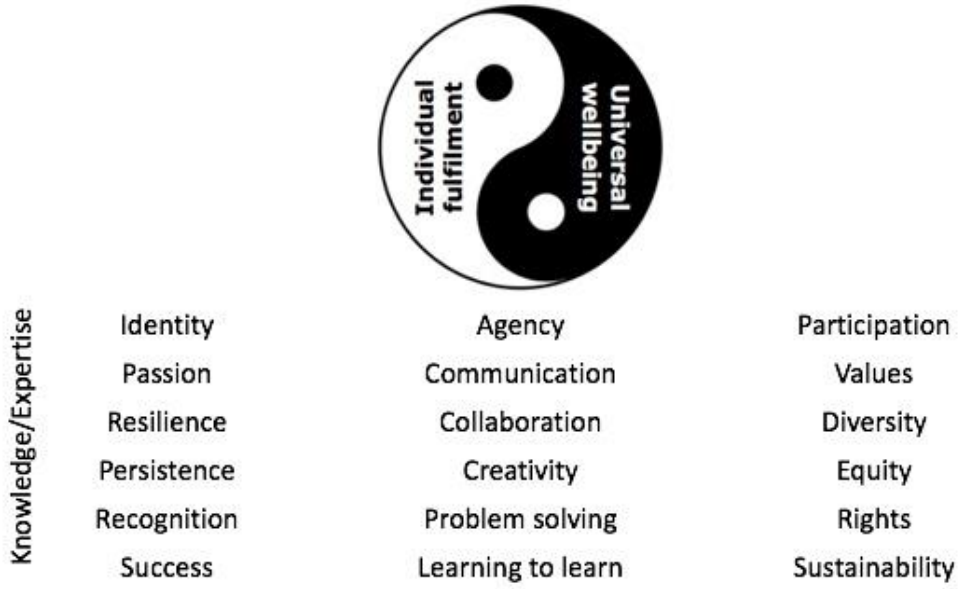

Figure 4: The Educational Vision and Mission Framework (Twining, 2017)

Within a sociocultural framework, knowledge is seen as the ability to act within a community of practice using valued cultural tools of society (e.g. digital technologies). Thus knowledge is not a fixed entity but is seen as dynamic (in contrast to information). Expertise relates to the status (degree of embedding) of the individual within that community.

The elements in the left hand coloumn in Figure 4 relate to individual fulfilment, and in particular to recognition and success in achieving some purpose which you find meaningful (the thing(s) that you are passionate about). In order to achieve that success and recognition you need resilience and persistence. Individual fulfilment is thus closely linked to your identity – how you view yourself in relation to the community of practice.

The elements in the right hand column relate to universal wellbeing. Participation is fundamental to a sociocultural model and to both an individual's and community's wellbeing. Universal wellbeing depends upon each individual's well being, which is underpinned by issues of equity and recognition of their rights. Shared values are important to wellbeing, and in a world in which different

communities hold different values, appreciation of diversity is critical. Universal wellbeing does not just refer to humans however, but recognizes the importance of plants, animals and the environment and their sustainability.

The individual and the collective are insparable within a sociocultural model. The central column thus includes key elements that link them together. Agency refers to the ability to act, including making meaningful decisions, which provides a bridge between identity and participation. Communication and collaboration are key to both community and individual wellbeing. Problem solving and being creative (in the sense of being able to imagine new possibilities as well as in the big C artistic sense) are crucial to tacking challenges of sustainability. Learning to learn is perhaps the most fundamentally important skill needed in a rapidly changing world, where the future is uncertain.

The EVMF provides a universally applicable framework, within which locally relevant contextualisation can take place. For example, whilst in every educational jurisdiction the issue of values is important, different education systems may be underpinned by different sets of values. However, in every case those values should be addressed.

The EVMF aims to facilitate bottom up as well as top down engagement. It complements the UNESCO Framework, which whilst it has implicit within it three different purposes (Technology Literacy, Knowledge Deepening, Knowledge Creation), does not aim to facilitate discussion of the values and beliefs underpinning those three positions or indeed to explicitly link them to different theoretical positions.

Conclusions

This paper has outlined the importance of alignment of, with and for what purpose, indicating the symbiotic nature of the relationship for policy makers who wish to align their education systems in a way that will develop learners for the complex, connected world we live in.

Members of TWG1 agreed that the EVMF is applicable across a wide range of diverse global contexts and the paper recommends its use as a framework to support reflection on educational visions and missions in a rapidly changing world.

In tandem with considering the purpose of schooling and the associated vision and mission, policy makers need to reflect on the varying elements that encompass a learning eco-system. The UNESCO framework is proposed as "an object to think with" (Papert, 1980).

The Irish example illustrates how using the UNESCO framework has enabled policy makers to adopt a systemic approach to policy formulation which aligns educational strategies across a range of elements "to leverage strengths, coordinate investments, consolidate gains, and advance national development goals and visions" (Kozma, 2005, p.148). This approach addresses what Moonen (2008) identifies as "the main challenge of a transformational policy with respect to IT and education" (p.1077). As noted previously, simply introducing ICT into an education system as a way of stimulating transformation and disregarding the impact of such an intervention on many other aspects of the system, is almost a guarantee for failure. Using the UNESCO framework enabled policy makers to be more cognizant that the multitude of actors and factors playing a role in an educational system are very much connected to each other. Moonen (2008) uses the analogy of the cogwheels of a watch to capture this interconnectedness: "turning one wheel starts or follows the turn of many other connected wheels". However, there is a danger that the framework could be used in a top-down approach, without being balanced by a bottom-up engagement, evident in the Irish example. Underpinning the effective implementation of one's educational vision, and ensuring alignment with policies and practice requires shared ownership of both the vision and the associated policies. Thus implementation needs to involve stakeholders in genuine dialogue (see also Gibson et al., 2018 in this issue).

The EVMF provides a powerful tool to support both bottom-up and top-down discussion about the key elements that make up your educational vision and underpinning beliefs and values. Itcomplements the use of the UNESCO

framework by explicitly supporting thinking about what your educational vision and mission should be, prior to thinking about the strategies that might most usefully be implemented to achieve your vision. Such an approach could provide the leverage for transformational change (Kozma, 2008). The resulting strategies would differ from country to country, but "regardless of the starting point and subsequent trajectory, the intent is that by aligning policies and programs across factors and sectors" (Kozma, 2005, p.148) application of the UNESCO framework and EVMF could enable the necessary alignment that supports the educational, social, and economic transformation necessary for the complex, connected, global world of today and tomorrow.

References

Adler, M. J. (1982). *The Paidea proposal: An educational manifesto*. New York: Collier Macmillan.

Becker, H. (2000). The "exemplary teacher" paper - How it arose and how it changed its author's research program. *Contemporary Issues in Technology and Teacher Education* (2). Retrieved January 14 2018 at: http://www.citejournal.org/vol1/iss2/seminal/article2.htm

Binkley, M., Erstad, O., Herman, J., Raizen, S., Ripley, M., Miller-Ricci, M. & Rumble, M. (2012). Defining twenty-first century skills. In P. Griffin, B. McGaw and E. Care (Eds.), *Assessment and teaching of 21st century skills* (pp. 17-66). Springer, Netherlands.

Bransford, J., Brown, L., & Cocking, R. (2000*). How people learn: Brain, mind, experience, and school:* Expanded Edition. Washington, D. C.: National Academy Press.

Butler, D., Leahy, M., Shiel, G., & Cosgrove, J. (2013). *Building towards a learning society: A national digital strategy for schools*. Dublin: St. Patrick's College of Education, Education Research Centre.

Butler, D., Hallissy, M., & Hurley, J. (2018). The digital learning framework: What digital learning can look like in practice, an irish perspective. In *Society for Information Technology & Teacher Education International Conference*(pp. 1339-1346). Association for the Advancement of Computing in Education (AACE).

Conlon, T. (2000) Visions of change: Information technology, education and postmodernism. *British Journal of Educational Technology*, 31(2) pp.109-116.

Conway, P. & Brennan, E. (2009). National policies and practices on ICT in education: Ireland (pp. 383-402). In T. Plomp, N. Law & J. Pelgrum (Eds.) (2009*). Cross-national information and communication technology. Policies and practices in education*. Charlotte, North Carolina: Information Age Publishing.

Cosgrove, J., Butler, D., Leahy, M., Shiel, G., Kavanagh, L., Creaven, A., (2014). *The 2013 ICT census in school report.* Dublin: Educational Research Centre

Cosgrove, J., & Marshall, K. (2008). *ICT access and usage in Irish primary schools: Identifying the gaps*. Dublin: Liffey Press.

Counts, G. S. (1978). *Dare the schools build a new social order?* Carbondale, IL: Southern Illinois University Press.

Darling-Hammond, L., & Bransford, J. (Eds.). (2007). *Preparing teachers for a changing world: What teachers should learn and be able to do*. John Wiley & Sons.

DES (1997). *Schools IT2000*. Dublin: Author. Retrieved January 14 2018 at: https://www.education.ie/en/Publications/Policy-Reports/Schools-IT2000.pdf

DES (2001). *Ireland blueprint for the future of ICT in education*. Dublin: Author Retrieved January 14 2018 at: http://www.ncte.ie/cao/documents/d247.PDF

DES. (2008). *ICT in schools. Inspectorate evaluation studies.* Dublin: Author. Retrieved January 14 2018 at: http://www.education.ie/en/Publications/Inspection-Reports-Publications/Evaluation-Reports-Guidelines/ICT-in-Schools-Inspectorate-Evaluation-Studies.pdf

DES (Department of Education and Skills). (2011). *Literacy and numeracy for learning and life. The national strategy to improve literacy and numeracy among children and young people. 2011-2020.* Dublin: Author. Retrieved January 14 2018 at: https://www.education.ie/en/Publications/Policy-Reports/lit_num_strategy_full.pdf

DES. (2012). *A framework for Junior Cycle.* Dublin: Author. Retrieved January 14 2018 at: http://www.education.ie/en/Publications/Policy-Reports/A-Framework-for-Junior-Cycle-Full-Report.pdf

DES Inspectorate. (2012a). *An introduction to school self-evaluation of teaching and learning in primary schools. Inspectorate guidelines for schools*. Dublin: Retrieved January 18 2018 at http://schoolself-evaluation.ie/primary/wp-content/uploads/2012/11/An-Introduction-to-School-Self-Evaluation-of-Teaching-and-Learning-in-Primary-Schools.pdf

DES Inspectorate. (2012b). *School self-evaluation. Guidelines for post-primary schools. Inspectorate guidelines for schools.* Dublin: Author. Retrieved January 14 2018 at: http://www.education.ie/en/Publications/Inspection-Reports-Publications/Evaluation-Reports-Guidelines/sse_guidelines_post_primary.pdf

DES (2015). *The digital strategy for schools, 2015-2020*. Dublin; Author. Retrieved January 14 2018 at: https://www.education.ie/en/Publications/Policy-Reports/Digital-Strategy-for-Schools-2015-2020.pdf

DES (2016a). *Looking at our schools : A quality framework for primary schools.* Dublin: Author Retrieved January 14 2018 at: http://www.education.ie/en/Publications/Inspection-Reports-Publications/Evaluation-Reports-Guidelines/Looking-at-Our-School-2016-A-Quality-Framework-for-Primary-Schools.pdf

DES (2016b) *Looking at our schools : A quality framework for post-primary schools.* Dublin: Author. Retrieved January 14 2018 at: http://www.education.ie/en/Publications/Inspection-Reports-Publications/Evaluation-Reports-Guidelines/Looking-at-Our-School-2016-A-Quality-Framework-for-Post-Primary-schools.pdf

DES (2017a). *The digital learning framework for primary schools*. Dublin: Author. Retrieved January 14 2018 at: http://www.pdsttechnologyineducation.ie/en/Planning/Digital-Learning-Framework/Digital-Learning-Framework-Primary.pdf

DES (2017b). *Digital learning framework for post-primary schools.* Dublin: Author. Retrieved January 14 2018 at: http://www.pdsttechnologyineducation.ie/en/Planning/Digital-Learning-Framework/Digital-Learning-Framework-Post-Primary.pdf

Dewey, J. (1934). Individual psychology and education. *The Philosopher* 12, Retrieved January 14 2018 at: http://www.the-philosopher.co.uk/2016/08/individual-psychology-and-education-1934.html

Dewey, J. (1938). *Experience and education*. New York: Simon and Schuster.

Ertmer, P. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration?, *Educational Technology Research and Development* (ETR&D), 53(4), pp. 25-39.

ETA (European Training Agency). (2010). *Key competences.* Retrieved January 14 2018 at: http://www.etf.europa.eu/web.nsf/pages/Key_competences_EN?OpenDocument

European Schoolnet and University of Liège. (2013). *Survey of schools: ICT in education. Benchmarking access, use and attitudes to technology in Europe's schools*. Final Report

(ESSIE). Brussels: European Union. Retrieved January 14 2018 at: http://ec.europa.eu/digital-agenda/sites/digital-agenda/files/KK-31-13-401-EN-N.pdf

Eurydice (2011). *Key data on learning and innovation through ICT at school in Europe*. Retrieved January 14 2018 at: http://eacea.ec.europa.eu/education/eurydice/documents/key_data_series/129en.pdf

Ford, M. (2009) *The lights in the tunnel: automation, accelerating technology and the economy of the future*. Wayne (Pennsylvania): Acculant Publishing.

Fullan, M. (2013). *Stratosphere: Integrating technology, pedagogy, and change knowledge*. Canada: Pearson.

Hill, R. B. (2010). Excellence: The importance of vision and work ethic. *Technology and Engineering teacher*, *70*(2), 28-31.

Hallissy, M., & Hurley, J., (2016). *Adapting the UNESCO ICT competency framework for teachers, for Ireland - A literature review*. Dublin: H2 Learning.

Jones, K. (2012) *What is the purpose of education?* Retrived: August 15 2012 https://www.forbes.com/sites/sap/2012/08/15/what-is-the-purpose-of-education/#25ea55037795

Kozma**,** R. (Ed.), (2003). *Technology**,** innovation, and educational change: A global perspective***.** Eugene, OR: International Society for Educational Technology

Kozma, R. B. (2005). National policies that connect ICT-based education reform to economic and social development. *Human Technology: An interdisciplinary journal on humans in ICT environments.*

Kozma, R. (2008). Comparative analyses of policies for ICT in education. In J. Voogt & G.

Knezek (eds.), *International Handbook of Information Technology in Primary and Secondary Education (pp 10883-1096)*. Berlin: Springer Science.

Kozma, R. (2011). *Transforming education: The power of ICT policies*. Paris: UNESCO.

Labaree, D. F. (1997). Public goods, private goods: The American struggle over educational goals. *American Educational Research Journal*, *34*(1), 39-81.

Law, N. (2008). Teacher learning beyond knowledge for pedagogical innovations with ICT. In J. Voogt & G. Knezek (eds.), *International handbook of information technology in primary and secondary education*. Berlin: Springer Science.

Law, N., Pelgrum, J. & Plomp, T. (2008). *Pedagogy and ICT use in schools around the world: Findings from the IEA SITES 2006 study*. Hong Kong: The Comparative Education Research Centre.

Law, N. (2013). Forward. In T. Lee Yong & L. Cher Ping. *Creating holistic technology-enhanced learning experiences: Tales from a future school in Singapore*. Rotterdam/Boston/Tapei: Sense Publishers.

Law, N., Niederhauser, D. S., Christensen, R., & Shear, L. (2016). A multilevel system of quality technology-enhanced learning and teaching indicators. *Journal of Educational Technology & Society*, *19*(3), 72.

Li, Q., & Ma, X. (2010). A meta-analysis of the effects of computer technology on school students' mathematics learning. *Educational Psychology Review, 22,* 215-243.

Martin, J., McCormack, B., Fitzsimons, D., & Spirig, R. (2014) The importance of inspiring a shared vision. *International Pratice Development Journal*, 4(2), pp.1-15.

Moonen, J. (2008). Policy from a global perspective. In *international handbook of information technology in primary and secondary Education* (pp. 1083-1096). Springer US.

National College of School Leadership (NCSL) (2003). *NPQH Access Stage Unit 1.2: Vision into action.* NCSL, Nottingham.

National College of School Leadership (NCSL) (2004). *NPQH Development Stage Unit 1.1: Developing a strategic eduational vision.* NCSL, Nottingham.

NCCA (National Council for Curriculum and Assessment). (2008). *Developing post-primary mathematics education. Project Maths: An overview*. Dublin: Author. Retrieved January 14 2018 at http://www.ncca.ie/uploadedfiles/publications/vacancies/project%20maths%20overview.pdf

NCCA (2009). *Senior cycle key skills framework*. Dublin: Author. Retrieved January 14 2018 at http://www.ncca.ie/en/Curriculum_and_Assessment/Post-Primary_Education/Senior_Cycle/Key_Skills_Framework/KS_Framework.pdf

OECD (Organisation for Economic Cooperation and Development). (2005). *The definition and selection of key competencies*. Paris: Author. Retrieved January 14 2018 at: http://www.oecd.org/document/17/0,3343,en_2649_39263238_2669073_1_1_1_1,00.html

OECD, (2015). *Students, computers and learning: Making the connection*. OECD Publishing, Paris. http://dx.doi.org/10.1787/9789264239555-en

Owston, R. (2003). School context, sustainability, and transferability of innovation. In R. Kozma**,** (Ed.), (2003). *Technology**,** innovation, and educational change: A global perspective***.** Eugene, OR: International Society for Educational Technology.

Papert, S. (1980*). Mindstorms: Children, computers, and powerful ideas*. Basic Books, Inc..

Partnership for 21st Century Skills. (2008). *21st century skills, education and competitiveness: A resource and policy guide*. Washington, DC: Partnership for 21st Skills. Retrieved January 14 2018 at: http://www.p21.org/storage/documents/21st_century_skills_education_and_competitiveness_guide.pdf

Plomp, T., Law, N. & Pelgrum, J. (Eds.) (2009). *Cross-national information and communication technology. Policies and practices in education.* Charlotte, North Carolina: Information Age Publishing.

Robeyns, I. (2006). Three models of education: Rights, capabilities and human capital. *School Field*, *4*(1), 69-84.

Russell, C. (2016). *System supports for 21st century competencies*. Asia Society: Centre for Global Studies. Retrieved January 14 2018 at: https://asiasociety.org/files/system-supports-for-21st-century-competencies-2016_0.pdf

Sandholtz, J. H., Ringstaff, C., & Dwyer, D. C. (1997). *Teaching with technology: Creating student-centered classrooms*. New York: Teachers College Press.

Shear, L., Gorges, T., Means, B., Singleton, C., Novais, G., Gallagher, L., & Lundh, P. (2010). *The Microsoft innovative schools program year 2 evaluation report*. Redmond, WA: Microsoft. Retrieved November 26 at: http://www.microsoft.com/en-us/download/details.aspx?id=9791

Shear, L., Gallagher, L., & Patel, D. (2011). *ITL Research 2011 findings: Evolving educational ecosystems.* Redmond, WA: Microsoft.

Talbot, K. (1994) *Visions for the future.* Coventry: NCET.

Teaching Council, (2011). *Policy on the continuum of teacher education*. Retrieved January 14 2018 at: http://www.teachingcouncil.ie/_fileupload/Teacher%20Education/FINAL%20TC_Policy_Paper_SP(1).pdf

Twining, P., Raffaghelli, J., Albion, P. & Knezek, D. (2013) Moving education into the digital age: the contribution of teachers' professional development. *Journal of Computer Assisted Learning*, 29, pp.426-437. doi: 10.1111/jcal.12031 Retrieved January 14 2018 at: http://onlinelibrary.wiley.com/doi/10.1111/jcal.12031/full

Twining, P. (2014). Redefining Education: 1: 1 computing strategies in English schools. *Change*, *2*(6), 21.

Twining et al. (2017) NP3 – *New purposes, new practices, new pedagogy: Meta-analysis report*. London: Society for Educational Studies. Retrieved January 14 2018 at: http://edfutures.net/images/e/e7/NP3_Meta-analysis_report.pdf

Twining, P. (2017) *The Yin-Yang vision*. http://edfutures.net/Yin-Yang_vision (accessed 11-Jan-2018).

UNESCO (2008). *ICT competency standards for teachers: Competency standards modules*. Paris: UNESCO. Retrieved January 18 2018 at: http://unesdoc.unesco.org/images/0015/001562/156207e.pdf

UNESCO (2008a). *ICT competency standards for teachers: Policy framework*. Paris: UNESCO. Retrieved January 18 2018 at http://unesdoc.unesco.org/images/0015/001562/156210E.pdf

UNESCO (2011). *ICT competency standards for teachers: Policy framework*. Paris: UNESCO. Retrieved January 18 2018 at: https://iite.unesco.org/pics/publications/en/files/3214694.pdf

United Nations (2015). *Transforming our world: the 2030 agenda for sustainable development.* United Nations: New York.

Watson, G. (2001), Models of information technology teacher professional development that engage with teachers' hearts and minds. *Journal of Information Technology for Teacher Education*, 10, 179 – 190

Wong, B.L.W., & Blandford, A. (2002). *Analysing ambulance dispatcher decision making: Trialing emergent themes analysis*. London.